



Description of the final stadium larva of *Anisagrion allopterum* (Odonata: Coenagrionidae)

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(Received 11 April 2019; accepted 25 June 2019)

The final stadium larva of *Anisagrion allopterum* is described for the first time for Middle America, based upon specimens reared and emerging in the field, from Cartago, Province, Costa Rica. Detailed illustrations are also provided. The larva of this species is characterized by a slender yellow body, premental setae 4 + 1, five palpal setae, male cerci globose, and caudal lamellae densely tracheate.

Keywords: Neotropical Region; Costa Rica; Zygoptera; reared specimens; taxonomy; damselfly; dragonfly

Introduction

Anisagrion is a small genus of Neotropical damselflies distributed from southern Mexico to northern South America (Colombia, Venezuela and Ecuador) (Garrison, von Ellenrieder, & Louton, 2010; Rojas-Riaño, 2011). In Middle America it is represented by only three species: *Anisagrion allopterum* (Selys, 1876), *A. kennedyi* Leonard, 1937, and *A. truncatipenne* Calvert, 1902. To date, the only larva known of the genus is that of *A. inornatum* (Selys, 1876), described by Tennessen (2012), the only species recorded for South America. In this paper, we provide the description of the last stadium larva of *A. allopterum* based upon four exuviae (reared), and three F-0 larvae. This represents the first larval description of *Anisagrion* for Middle America.

Methods

Mature larvae were collected with an aquatic net and transported to the laboratory for rearing. Emerged adults were maintained alive for a few days and preserved after death in 95% ethanol, together with their exuviae. Additional larvae preserved in ethanol 96% were also examined. The descriptions and measurements (in mm) were made using a Nikon SMZ745 stereomicroscope with a calibrated ocular micrometer. Photographs of morphology were taken with a Nikon SMZ25 stereomicroscope (Chiyoda-ku, Tokyo, Japan) and its mounted Nikon DS-U3 camera, and processed with the program NIS elements AR version 4.5 (Laboratory Imaging s.r.o,

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Figure 1. *Anisagrion allopterum*, female. Habitus dorsal of the F-0 larva.

Praha, Czech Republic). Mandible nomenclature follows Watson (1956) and labium nomenclature follows Corbet (1953). Abbreviations are as follows: AL, abdomen length (without caudal lamella); FfL, fore femur length; HfL, hind femur length; MfL, medium femur length; Ce, cerci; MgL, male gonapophyses length; FgL, female gonapophyses length; MWh, maximum width of head; TL, total length (including caudal lamellae); S1–S10, abdominal segments; F-0, ultimate stadium; Ep, epiproct; Pp, paraproct; MZUCR, Museo de Zoología, Universidad de Costa Rica; IEXA, Colección Entomológica “Miguel Angel Morón Ríos” del Instituto de Ecología, A.C. Specimens are deposited in MZUCR and IEXA.

Final stadium larva of *Anisagrion allopterum*

(Figures 1–6)

Specimens examined

Four exuviae (3♀, 1♂, emerged), 3 F-0 larvae (2♀, 1♂). **COSTA RICA: Cartago; Paraíso,** Jardín Botánico Lankester (9.84011 N; 83.88931 W; elevation 1369 m); 23 February 2018 (2♀, emerging in the field); 15 March 2018 (1♂, emerged 16 March 2018); 13 April 2018 (2♀, one

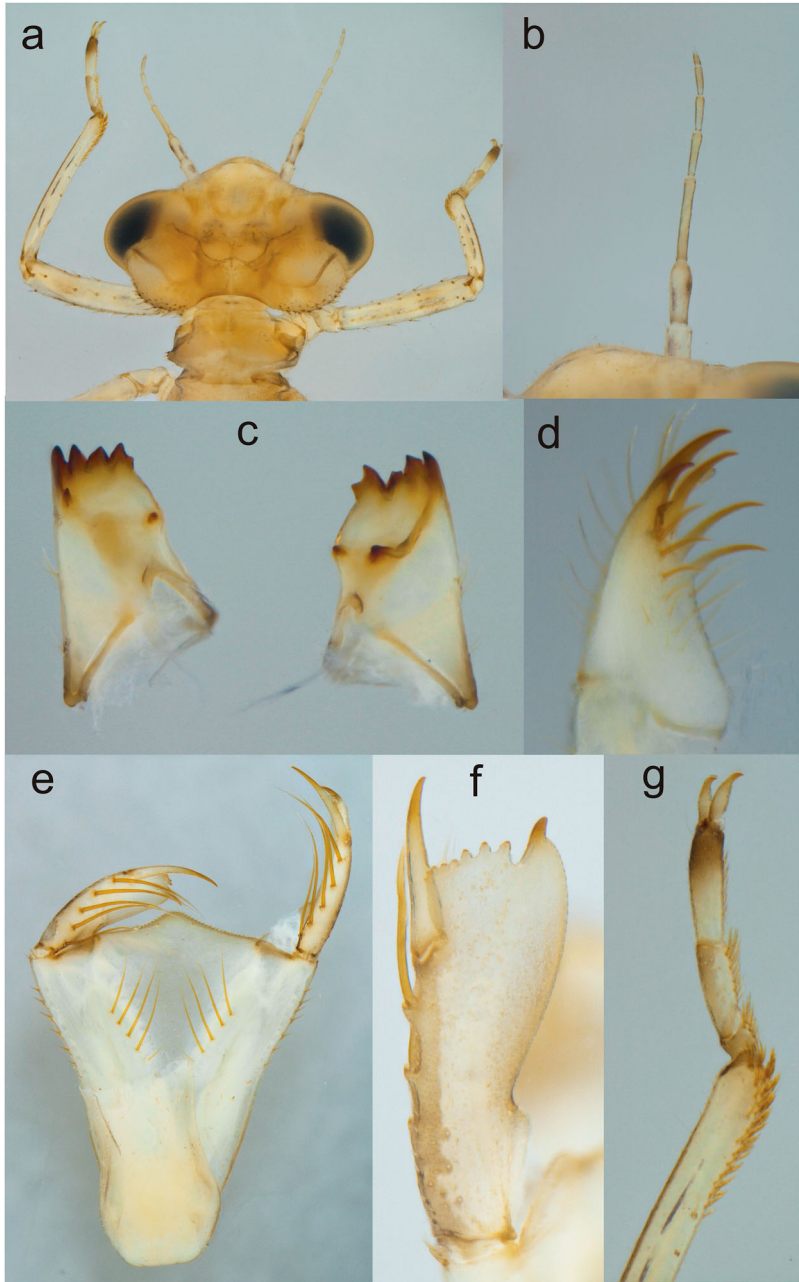


Figure 2. *A. allopterum* details of larval morphology. (a) Head of male, dorsal view; (b) right antenna, dorsal view; (c) mandibles, ventrointernal view; (d) right galeolacinia, ventral view; (e) dorsal view of prementum showing premental setae, laterodorsal spiniform setae, and palp setae; (f) labial palp, anterior view; (g) distal end of tibia and tarsomeres of foreleg, dorsolateral view.

emerged 30 April 2018, the second one emerged 1 May 2018); 25 September 2018 (1♂). Laguna Doña Ana (9.83291 N; 83.87810 W; elevation 1345 m); 9 April 2018 (1♀, reared, no data of emergence available), all J. Román-Heracleo leg. Specimens deposited at IEXA (two larvae), all other in MZUCR.

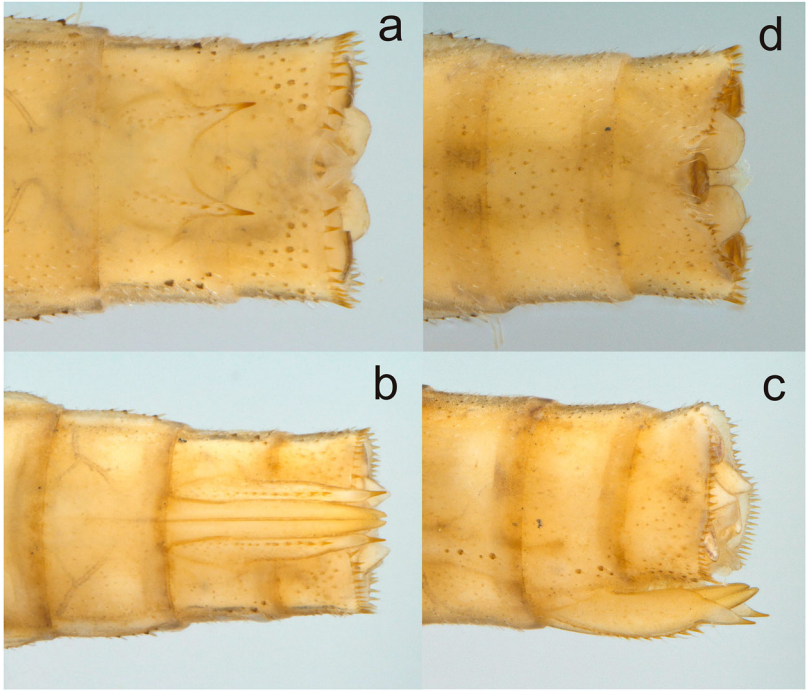


Figure 3. *A. allopterum*, S8–10 (caudal lamellae detached). (a) Male gonapophyses and cerci, ventral view; (b) female gonapophyses, ventral view; (c) lateral view of female gonapophyses and cerci; (d) male cerci, dorsal view.

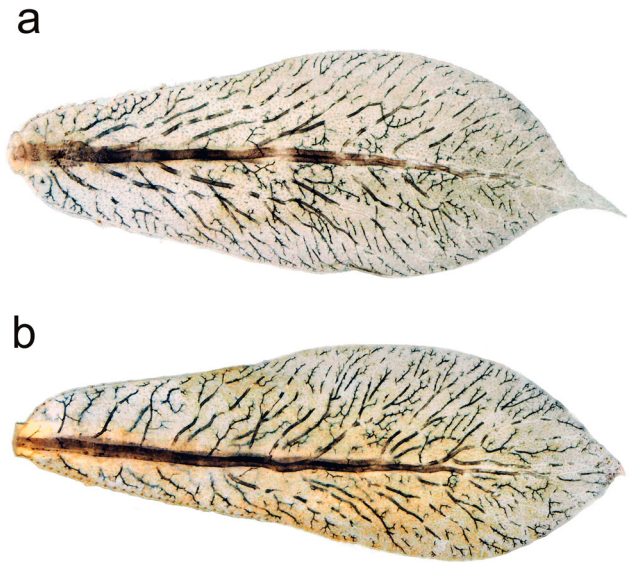


Figure 4. *A. allopterum*, caudal lamellae, left lateral view. (a) Epiproct; (b) paraproct.

Description

Exuviae and mature larvae mostly yellowish, slender, femora slightly banded, caudal lamellae markedly tracheate (Figure 1).

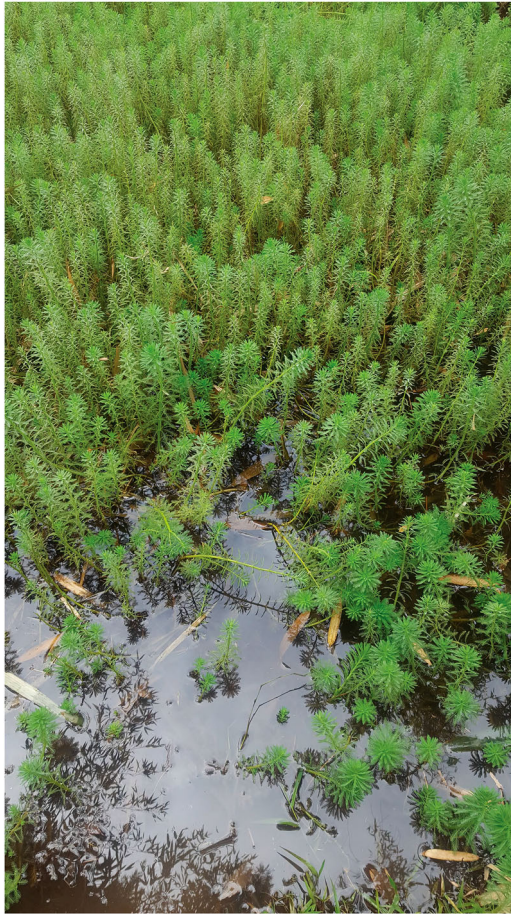


Figure 5. *Myriophyllum* sp. (Haloragaceae) in the Botanical Garden Lankester, detail of the larval habitat of *A. allopterum*, Paraíso, Cartago.



Figure 6. Larval habitat in lake Doña Ana, Paraíso, Cartago.

Head. Subpentagonal, almost twice as wide as long, wider than thorax and abdomen (Figure 1). Labrum ventral margin concave at middle, with scattered setae on surface; clypeus mostly glabrous; frons and vertex flat; minute granules on vertex close to compound eyes internal margin. Occipital margin (Figure 2a) widely concave; cephalic lobes rounded, with stout spiniform setae. Antennae (Figure 2b) filiform, 7-segmented, scape and pedicel cylindrical, with a lateral, longitudinal, brown stripe to each side, flagellomeres elongated, 3rd antennomere the longest, antennomeres 3–6 uniformly yellowish, basal half of 7th antennomere light yellowish-brown, the distal half translucent, size proportions of antennomeres: 0.40, 0.70, 1.0, 0.60, 0.40, 0.40, 0.20. Compound eyes moderately developed, wider than long, laterally prominent. Mandibles (Figure 2c) with formula: $R \ 1 + 2345 \ y \ a / L \ 1 + 2345 \ 0 \ a \ b$, $b > a$. Maxilla's galeolacinia (Figure 2d) with six teeth, three dorsal teeth slightly incurved, similar length and robustness, with a basal row of seven long thin setae, three ventral teeth of different size and robustness, size proportions: apical tooth 1.0, median one 0.55, basal tooth a mere spine, with a basal row of strong stiff setae which increase suddenly in size and robustness apically, maxillary palp gently incurved, ending in a stout spine, with long setae on the external surface. Ventral pad of hypopharynx subpentagonal, anterior margin convex, basal half with large setae, distal half glabrous, three setae on each anterolateral corner. Labium: Prementum–postmentum articulation reaching mesocoxae; prementum (Figure 2e) longer than wide, subrhomboidal, lateral margins slightly concave, widely divergent apically, laterodorsal margin with a row of seven, rarely 6, 8 or 9 spiniform setae and a group of three very tiny basidorsal spiniform setae, forming a triangle; ligula with tip prominent, convex, finely serrulated, with a minute submarginal spine two each side of midline; 4 + 1 long premental setae to each side of midline, rarely 3 + 1. Labial palp (Figure 2e, f) creamy pale with a dorsoexternal, longitudinal, darker stripe (Figure 2f), with five long setae, rarely six, its apical lobe (Figure 2f) divided into a squarely truncate dorsal branch which has the distal margin with three small inferior teeth more or less of the same size and robustness, and 4–5 superior minute denticles, and a ventral branch with a well-developed end hook, slightly down curved; internal margin of palp finely serrate; movable hook scarcely more than half the length of labial palp, sharply pointed.

Thorax. Pronotum (Figure 2a) yellowish-brown, subtrapezoidal, posterolateral margin angled, brown, serrate, with 7–9 lateral, small, spiniform setae, posterior margin as shown in Figures 1 and 2a. Synthorax yellow dorsally, yellowish-brown laterally; anterior and posterior wing sheaths reaching the distal third of S4 (Figure 1). Legs long (e.g. when fully extended, hind legs reaching posterior margin of S10, articulation of hind femur reaching posterior margin of S4), slender, yellow pale, with a thin, dorsal, longitudinal brown stripe on femora and tibiae. Femora with a subapical, diffuse band, a dorsal, longitudinal carina on fore- and middle femora, hind femora double-carinated, dorsal and ventral borders with a row of spiniform setae (Figure 1). Tibiae spiny on ventral (internal) surfaces, dorsal (external) surfaces with long delicate setae, apicointernal third with abundant tridentate setae (Figure 2g). Tarsi with two ventral rows of spiniform setae, basal tarsomere light brown, distal tarsomere with basal half yellow, distal half dark brown (Figure 2g), all tarsi with long and delicate setae on dorsal surface, claws simple, with pulvilliform empodium.

Abdomen. S1–10 yellowish (Figure 1), S2–8 with a thin, pale, middorsal line, S5–9 with a reddish-brown, subrectangular spot to each side of pale middorsal line which reduces in length gradually on posterior segments. S1–10 gradually narrowing posteriorly, dorsal surface of S5–10 with spiniform setae which increase in abundance and robustness caudad, S7–10 with a transversal, subapical row of spiniform setae which increase in robustness caudad; posterior margin of S10 with 3–6 stout enlarged setae to each side of the elevated, indented, dorsal midline. S3–8

laterally carinate, S9–10 lacking carina, S1–S7 with spiniform setae not disposed at one row, S8–S10 with spiniform setae increasing in number posteriorly. Sterna 1–4 lacking spiniform setae, sterna 5–10 with spiniform setae, abundant at sides, scarce at middle. Posterior margin of sterna 1–9 with delicate, minute setae, S10 with a row of stout spiniform setae in posterior margin. Male gonapophyses (Figure 3a) long, surpassing well beyond the posterior margin of sternite 9, divergent in ventral view, sharply pointed, ventral border with a row of eight spines and a long seta at the base of each spine, increasing in robustness apically. Female gonapophyses (Figure 3b, c) surpassing well beyond the posterior margin of sternite 10, external valve slightly longer than internal valve, their ventral border with a basal row of 19 spines, increasing in size and robustness caudad, a long seta at the base of each spine, distal 0.25 bare; lateral valve sharply pointed, central valve roundly tipped. Caudal lamellae (Figure 4) membranous, densely tracheated, with a slight ambarine tint, without nodus. Epiproct (Figure 4a) subovate, 2.5 times longer than their widest part, basal 0.40 of dorsal margin with 32 spines, basal 0.25 of ventral margin with 12 spines, abruptly tapered into a large, triangular tip. Paraproct (Figure 4b) lanceolate, basal 0.25 of dorsal margin with 14 spines, basal 0.45 of ventral margin with 29 spines, tip similar to that of epiproct but shorter, remainder of margins in both epi- and paraprocts with a scarce, minute, very fine setae. Male cerci wider than long, globose (Figure 3a, d), female cerci conical (Figure 3b, c).

Measurements

TL 15.5; AL 6.8–7.0; FfL 1.5; MfL 2.0; HfL 2.5; MWh 3.0; MgL 0.5; FgL 1.10. Ep maximum length 4.7, maximum width 1.8; Pp maximum length 4.9, maximum width 1.8; Ce 0.1.

Diagnosis

Anisagrion allopterum differs from *A. inornatum* (characteristics of the latter in parentheses) by having a larger width of head: 3 mm (2.2–2.3); antenna total length 1.8 (2.0), premental setae 4 + 1 (usually 4); lateral margin of prementum usually with seven spiniform setae (12–15); paraprocts with 29 spines on ventral series (40); frons mostly yellowish (predominantly dark to light brown); tip of ligula narrow (widely convex); distal tarsomeres bicolored (pale).

Habitat

Larvae of *Anisagrion allopterum* were found in artificial lakes associated to aquatic plants of the genus *Myriophyllum* sp. (Haloragaceae) in the Botanical Garden Lankester (Figure 5), and to *Nymphoides* sp. (Menyanthaceae) at the recreational park Doña Ana (Figure 6), both in Paraíso, Cartago Province. During a year of collections, the emergence activity was observed in April in Lankester, and December in lake Doña Ana. Tennessen (2012) reported larvae of *A. inornatum* from a small, shallow stream, with abundant aquatic and semi-aquatic plants, so it is possible that larvae of *A. allopterum* can be found also in pool areas of some streams in Middle America.

Acknowledgements

The first author is grateful to SINAC for the collecting permit, as well as to Sistema de Estudios de Posgrado UCR for financial support to carry out an internship at INECOL. Thanks are due to Dr J. Antonio Gómez-Anaya for editing the images accompanying this manuscript. We also thank Dr Diogo Vilela and an anonymous reviewer for their valuable comments which improved the final version.

Funding

Fieldwork was supported by R.T. COX for stipend of investigation.

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